

COVER TAPE FOR ELECTRONIC PART CONVEYANCE AND
ELECTRONIC PART CONVEYING MEMBER

Background of the Invention

5 1. Field of the Invention

The present invention relates to an electronic part conveying member to be used for conveyance of a chip type electronic part, or the like, until it is mounted on a board, and a cover tape to be used for the electronic part conveying member.

2. Description of the Related Art

As a common conveyance embodiment for a chip type electronic part, such as a chip fixing resistor, and a laminated ceramic capacitor, a taping reel method using a tape for conveying an electronic part (electronic part conveying member) is known. According to the taping reel method, an electronic part is inserted into electronic part storage pockets provided by a certain distance in the longitudinal direction of a plastic or paper carrier tape, and the electronic part is sealed by thermally sealing the upper surface with a cover tape so as to be wound up on a reel and conveyed. In a production step of a circuit board, or the like after conveyance, after peeling off the cover tape, an automatic assembly system for automatically suctioning the inserted electronic part by an air nozzle for supplying the same onto a board is mainly used.

In a series of steps from taping to the chip supply to a board, a problem is involved in that the electronic part packaged by taping adheres or melts on the tape adhesive layer surface so as not to be picked up by a suction nozzle at the time of peeling off the cover tape. Moreover, recently, according to the trend toward a light weight, a thin and short shape, a small size, and a high function of the electronic parts such as an IC, there is a high risk of deterioration or destruction of the electronic parts due to the static electricity generated by contact with a carrier tape or a cover tape, or the static electricity generated at the time of peeling off a cover tape. Furthermore, due to variation in the peel strength of a cover tape, an electronic part stored at a predetermined position may come out from a storage pocket, or displacement thereof may occur. Therefore, for such a cover tape for the electronic part conveyance, a countermeasure for the static electricity for reducing the contact electrification voltage and the peeling electrification voltage is called for as well as reduction of the peel strength variation is demanded.

As to the static electricity countermeasure, for only providing a conductivity, a method of applying a conductive coating on the adhesive layer surface of a cover tape, or impregnating a cover tape with a conductive agent can be adopted (see JP-A-10-86993). However, according to the method, the adhesive property of the cover tape is lowered, and thus the

function of sealing an electronic part cannot be provided sufficiently. Moreover, as a countermeasure for the static electricity, a method of providing an inorganic substance layer comprising an intermediate layer and a metal foil layer or an inorganic deposition layer between a sealant layer (adhesive layer) and a stretched resin layer (substrate) of a cover tape (see JP-A-8-112880), and a method of including or applying conductive fine particles of a metal oxide, or the like, or a carbon black in an adhesive layer or a substrate have been proposed. However, according to the methods, in providing a sufficient conductivity, a problem is involved in that the transparency (light transmittance) of the cover tape is lowered so that confirmation of a tape by visual recognition or an image process is disturbed, or variation in the peel strength of the tape is enlarged.

Summary of the Invention

Accordingly, an object of the invention is to provide a cover tape for the electronic part conveyance having both good conductivity and appropriate adhesive property, capable of preventing electrostatic destruction of an electronic part due to the friction electrification by the vibration, or the like during transportation of the electronic part or by the contact with the cover tape adhesive layer surface, peeling electrification at the time of peeling off the cover tape, or the like, capable of reducing the peel strength variation at

the time of peeling off, and capable of preventing projection, or the like of the electronic part from an electronic part conveying member.

Another object of the invention is to provide a cover
5 tape for the electronic part conveyance having a high transparency so as to allow preferable visual recognition of an electronic part, in addition to the above-mentioned characteristics.

Still another object of the invention is to provide
10 an electronic part conveying member comprising a cover tape having the above-mentioned excellent performances.

As a result of elaborate discussion of the present
inventors for achieving the above-mentioned objects, it was found that by providing a specific layer between a substrate
15 and an adhesive layer as well as forming a conductive layer on at least one selected from the group consisting of the substrate rear surface and the adhesive layer front surface by deposition, troubles of an electronic part derived from the static electricity can be prevented, variation in the peel
20 strength at the time of peeling off can be reduced, and further, the transparency can be retained so as to complete the invention.

That is, the invention provides a cover tape for the
electronic part conveyance comprising laminated members in four
or more layers, including at least one selected from the group
25 consisting of a base coating layer and an intermediate layer,

and an adhesive layer, laminated successively on a substrate as well as a conductive layer formed on at least one selected from the group consisting of the substrate rear surface and the adhesive layer front surface by deposition.

5 Moreover, the present invention provides an electronic part conveying member comprising an electronic part storage member for storing an electronic part, and a cover tape for covering the electronic part storage member, wherein the above-mentioned cover tape for the electronic part conveyance
10 is used as the cover tape.

Brief Description of the Drawings

Fig. 1 is a schematic cross-sectional view showing an embodiment of a cover tape for the electronic part conveyance according to the invention.

15 The reference numerals used in Fig. 1 are set forth below.

1: substrate

2: base coating layer

3: intermediate layer

20 4: adhesive layer

5: conductive layer (deposition layer)

Detailed Description of the Invention

Hereinafter, the invention will be explained in detail with reference to the drawings as needed.

25 FIG. 1 is a schematic cross-sectional view showing an

embodiment of a cover tape for the electronic part conveyance according to the invention. The cover tape for the electronic part conveyance comprises a base coating layer 2, an intermediate layer 3, and an adhesive layer 4 laminated on a substrate 1 in this order as well as a conductive layer 5 is provided on the rear surface of the substrate 1 and the front surface of the adhesive layer 4.

As the substrate 1, those having a self supporting property can be used. Examples thereof include paper; polyolefin based resins such as a polyethylene, and a polypropylene (for example, a high molecular weight polypropylene); polyesters such as a polyethylene terephthalate, a polybutylene terephthalate, and a polyethylene naphthalate; nylons (polyamide); plastic films or sheets of styrene resins such as a polystyrene.

As needed, to the substrate 1, commonly used additives, such as an antioxidant, a ultraviolet ray absorbing agent, a softener, a corrosion preventing agent, an inorganic particle, an antistatic agent (for example, a quaternary ammonium salt based one), a conductive metal powder, an organic conductive high polymer agent, and a titanium based or silane based coupling agent may be added.

It is preferable that the substrate 1 has a melting point of 90°C or more. In the case the substrate 1 melting point is less than 90°C, the substrate 1 may be contracted or

melted at the time of taping an electronic part so that the taping state becomes unstable, and thus there is a risk of drop off or projection of the electronic part.

The substrate 1 may be of either a single layer or a plurality of layers. The substrate 1 thickness is, in general, about 2 to 250 μm , and preferably about 20 to 200 μm . A commonly used surface treatment, such as a corona treatment may be applied to the surface of the substrate 1, whereon the base coating layer 2 is to be formed.

The base coating layer 2 is a layer for ensuring the inter-layer strength between the substrate 1 and the intermediate layer 3 (between the substrate 1 and the adhesive layer 4 in the case the intermediate layer is not provided). It can be formed with a known or commonly used adhesive. As a preferable adhesive comprising the base coating layer 2, a urethane adhesive, an organic electrostatic induction preventing adhesive, or the like, can be presented. By providing the base coating layer 2 by the organic electrostatic induction preventing agent, the static electricity preventing effect can further be improved so that, for example, the frictional electrification voltage of the adhesive layer side surface can be reduced dramatically. The base coating layer comprising the organic electrostatic induction preventing adhesive may be formed between the intermediate layer 3 and the adhesive layer 4. For example, it is possible to provide

the base coating layer comprising a urethane adhesive, or the like between the substrate 1 and the intermediate layer 3 as well as to provide the base coating layer comprising an organic electrostatic induction preventing adhesive between the intermediate layer 3 and the adhesive layer 4.

As the organic electrostatic induction preventing adhesive, for example, a compound made from a choline chloride, a methylmethacrylate, a 2-methylimidazol, or the like: product name "BONDEIP" produced by Altec Corp., can be used.

The thickness of the base coating layer 2 is about 0.05 to 30 μm . In the case the base coating layer 2 is made of a urethane adhesive, or the like, preferably it is about 0.05 to 10 μm . In the case the base coating layer 2 is made of an organic electrostatic induction preventing agent, if the thickness is too small, the frictional electrification voltage cannot be reduced considerably so that the effect of preventing adhesion of an electronic part on the adhesive layer 5 can hardly be obtained. Therefore, a 0.1 μm or more thickness is preferable. If the base coating layer 2 thickness is too large, problems can easily arise in that the winding diameter of the tape is increased so as not to be attached on a tape machine, or the like, and thus it is disadvantageous in terms of the cost. The base coating layer 2 can be formed by a commonly used coating method, or the like.

In the case the substrate 1 and the intermediate layer

3 can be laminated with a high adhesive strength, the base coating layer 2 need not always be provided.

[0019]

The intermediate layer 3 is a layer for improving the close contact property between the substrate 1 and the adhesive layer 4. It is made of, for example, a thermoplastic resin, such as a polyolefin based resin, a thermoplastic elastomer, a rubber, or the like. Among these examples, the polyolefin based resin is particularly preferable. Polymers comprising the intermediate layer 3 can be used alone or in a combination of two or more.

[0020]

Examples of the polyolefin based resins include polyethylenes (such as a low density polyethylene, a linear low density polyethylene, a metallocene catalyst method polyethylene, a middle density polyethylene, and a high density polyethylene), an ethylene- α -olefin copolymer; ethylene copolymers [such as ethylene-unsaturated carboxylic acid copolymers including an ethylene-acrylic acid copolymer (EAA), and an ethylene-methacrylic acid copolymer (EMAA); ionomers (such as a resin with a part of carboxyl groups of the ethylene-unsaturated carboxylic acid copolymer cross-linked with a metal); ethylene-(meth)acrylate copolymers such as an ethylene-methyl acrylate copolymer, an ethylene-ethyl acrylate copolymer (EEA), and an ethylene-methyl methacrylate

copolymer; an ethylene-vinyl acetate copolymer (EVA); and an ethylene-vinyl alcohol copolymer].

[0021]

As needed, a commonly used surface treatment, such as
5 a corona treatment, a plasma treatment, and a burner treatment
may be applied to the surface of the intermediate layer 3 for
improving the activity. The thickness of the intermediate
layer may be selected optionally in a range not to deteriorate
the handling property, or the like at the time of providing
10 a cover tape. In general, it is about 5 to 30 μm .

[0022]

The intermediate layer 3 can be formed by a commonly
used lamination method, such as an extrusion lamination method,
a co-extrusion method using a T die tandem extrusion laminator,
15 or the like, and a dry lamination method. In the case the
substrate 1 and the adhesive layer 4 can be laminated with a
high adhesive strength by the base coating layer 2, the
intermediate layer 3 need not always be provided.

[0023]

20 As the base polymer comprising the adhesive layer 4,
for example, thermoplastic resins such as a polyolefin based
resin, a polyester based resin, and a styrene based resin,
elastomers such as a thermoplastic elastomer, or the like, can
be used. These polymers can be used alone or in a combination
25 of two or more.

[0024]

Examples of the polyolefin based resins include polyolefins such as a polyethylene (such as a low density polyethylene, a linear low density polyethylene, a metallocene catalyst method polyethylene, a middle density polyethylene, and a high density polyethylene), a polypropylene, an α -olefin copolymer (such as an ethylene-propylene copolymer, an ethylene-butene-1 copolymer, and a propylene-butene-1 copolymer); and ethylene copolymers [such as ethylene-unsaturated carboxylic acid copolymers including an ethylene-acrylic acid copolymer (EAA), and an ethylene-methacrylic acid copolymer (EMAA); ionomers; ethylene-(meth)acrylate copolymers such as an ethylene-methyl acrylate copolymer, an ethylene-ethyl acrylate copolymer (EEA), and an ethylene-methyl methacrylate copolymer; an ethylene-vinyl acetate copolymer (EVA); and an ethylene-vinyl alcohol copolymer].

[0025]

Examples of the thermoplastic elastomers include styrene based thermoplastic elastomers (styrene based block copolymers; such as a styrene based block copolymer with a 5% by weight or more styrene content) such as an SIS (styrene-isoprene-styrene block copolymer), an SBS (styrene-butadiene-styrene block copolymer), an SEBS (styrene-ethylene-butylene-styrene block copolymer: a

hydrogenated product of an SBSS), an SEPS
(styrene-ethylene-propylene-styrene block copolymer: a
hydrogenated product of an SIS), and an SEP
(styrene-ethylene-propylene block copolymer); polyurethane
5 thermoplastic elastomers; polyester based thermoplastic
elastomers; blended thermoplastic elastomers provided, for
example, by the polymer blending of a polypropylene and an EPT
(a ternary ethylene-propylene rubber); a hydrogenated
polyisopylene based polymer, and a hydrogenated
10 polyisobutylene based polymer.

[0026]

To the adhesive layer 4, in general, a tackifier resin
is added. As the tackifier resin, for example, a petroleum
resin [such as an aliphatic petroleum resin (C5 based), an
15 aromatic petroleum resin (C9 based), and an alicyclic petroleum
resin with the aromatic petroleum resin hydrogenated], a rosin
based resin, an alkyl phenol resin, and a styrene based resin
can be presented. These tackifier resins can be used alone
or in a combination of two or more. By containing the tackifier
20 resin in the adhesive layer 4, the taping operativity is improved
as well as a stable and good adhesive force can be obtained
in a packaging base material such as a carrier tape.

It is preferable that the softening temperature of the
tackifier resin is 50°C or more. With a less than 50°C softening
25 temperature, the adhesive layer can easily be softened during

the transportation or storage so that an electronic part adheres or melts on the adhesive layer 4, and thus problems can easily be generated at the time of assembly in a circuit board, or the like.

5 The amount of the tackifier resin is about 2 to 100 parts by weight, preferably about 5 to 50 parts by weight with respect to 100 parts by weight of the base polymer. In the case the tackifier resin amount is less than 2 parts by weight, due to the low adhesive force, the tape may be lifted after
10 taping so that there is a risk of projection of the part. Moreover, in the case the tackifier resin amount is more than 100 parts by weight, due to the high adhesive force, the electronic part can adhere and melt on the adhesive layer 4 so that it is difficult to suck the electronic part with an
15 air nozzle at the time of assembly in a circuit board, or the like.

 The adhesive layer 4 may further contain additives such as a phosphorous based or phenol based antioxidant, an ultraviolet ray absorbing agent, a corrosion preventing agent,
20 a softener, a surfactant, an electrification preventing agent, a filler, a coupling agent, and a cross-linking agent. The amount of each additive is, in general, about 0 to 10 parts by weight (for example, 0.01 to 10 parts by weight) with respect to 100 parts by weight of the base polymer. With a more than
25 10 parts by weight additive amount, the adhesive property can

easily be lowered.

The thickness of the adhesive layer 4 can be selected optionally in a range not to deteriorate the adhesive property or the handling property. In general, it is about 2 to 90 μm .

5 With a less than 2 μm adhesive layer 4 thickness, the adhesive force is weak. With a more than 90 μm thickness, taping failure can easily be generated due to increase of the total tape thickness and sticking out of the glue at the time of taping.

The adhesive layer 4 can be formed by a commonly used
10 lamination method, such as an extrusion lamination method, a co-extrusion method using a T die tandem extrusion laminator, or the like, and a dry lamination method.

The conductive layer 5 is formed by deposition. The conductive layer 5 can be formed on both of the substrate 1
15 rear surface and the adhesive layer 4 front surface as in the embodiment shown in FIG. 1, but it can be formed only on either of the substrate 1 rear surface or the adhesive layer 4 front surface.

As the material provided for the deposition, any one
20 can be used as long as it can be deposited. Examples thereof include metals such as Al, Cu, Ag, Ni, Ti, Fe, Cr, Zr, Ta, and Zn, an alloy containing at least one of the above-mentioned metals including the SUS, and an inorganic oxide. Among these examples, a metal or an alloy containing the metal are
25 preferable.

The thickness of the conductive layer 5 provided by the deposition can be selected optionally without the range not to deteriorate the transparency, the adhesive property, or the like. In general, it is about 1×10^{-4} to $0.02 \mu\text{m}$. With a less than $1 \times 10^{-4} \mu\text{m}$ thickness, the static electricity preventing effect is lowered. With a more than $0.02 \mu\text{m}$ thickness, although the static electricity preventing effect is high, the transparency is deteriorated or the adhesive property with respect to the carrier tape is lowered, and thus it is not preferable. The deposition can be carried out by a commonly used method with a vacuum deposition device.

According to a cover tape for the electronic part conveyance of the invention, it is preferable that the surface resistivity of both surfaces is in a range from $10^2 \Omega/\square$ (Ω/square) to $10^{13} \Omega/\square$, in particular, in a range from $10^4 \Omega/\square$ to $5 \times 10^{12} \Omega/\square$. The surface resistivity can be adjusted optionally by selecting the kind of the material comprising the conductive layer 5, the thickness of the conductive layer 5, or the like.

It is preferable that the frictional electrification voltage of the adhesive layer side surface is 3,000 V or less, in particular, 1,000 V or less, particularly preferably 30 V or less. The frictional electrification voltage can be adjusted by optionally selecting the kind of the material comprising the conductive layer 5, the thickness of the conductive layer 5, the thickness of the base coating layer comprising

the electrification induction preventing agent, or the like.

Furthermore, according to a cover tape for the electronic part conveyance of the invention, it is preferable that the light transmittance is 60% or more, in particular, 70% or more. The light transmittance of the tape can be adjusted by optionally selecting the material comprising each of the substrate, the base coating layer, the intermediate layer, the adhesive layer and the conductive layer, and the thickness of each layer. In particular, since the conductive layer is formed by the deposition in the invention so that the conductivity can be provided by an extremely thin film thickness, a high transparency can be sustained.

An electronic part conveying member according to the invention comprises an electronic part storage member for storing an electronic part, and a cover tape for covering the electronic part storage member, wherein the cover tape for the electronic part conveyance is used as the cover tape.

As a representative example of such an electronic part conveying member, a conveying member comprising an emboss carrier tape with an electronic part storage recess member for storing an electronic part formed in a substantially center part in the width direction by a predetermined interval in the longitudinal direction, and a cover tape for the electronic part conveyance for covering the upper surface of the electronic part storage recess member can be presented.

As the material for the emboss carrier tape, those having a self supporting property can be used. Examples thereof include paper such as Japanese paper, crepe paper, synthetic paper, mixed paper, and composite paper; plastic films or sheets of a polyethylene, a polypropylene, a polyethylene terephthalate, a polyvinyl chloride, and cellophane; and a metal foil.

Moreover, as another example of an electronic part conveying member according to the invention, for example, a conveying member comprising a square hole punch carrier tape with a square punch hole formed for inserting a part, a bottom cover tape for covering the lower surface of the square hole of the square hole punch carrier tape, and a top cover tape for covering the upper surface of the square hole of the square hole punch carrier tape, can be presented. According to the conveying member, a cover tape for the electronic part conveyance of the invention can be used, for example, as the top cover tape.

A cover tape for the electronic part conveyance and an electronic part conveying member according to the invention can preferably be used widely for the conveyance of chip type electronic parts such as resistors including a chip fixing resistor, and capacitors including a laminated ceramic capacitor.

According to the invention, since a specific layer is

provided between the substrate and the adhesive layer of the cover tape as well as the conductive layer is provided by deposition on at least either of the substrate rear surface and the adhesive layer front surface, problems derived from the static electricity, such as the friction electrification due to vibration during the transportation of an electronic part, or the like, electrostatic destruction of an electronic part due to the contact with the cover tape adhesive layer surface, or peeling electrification at the time of peeling off the cover tape can be prevented. Moreover, since the conductive layer can be provided as an extremely thin film layer, a high transparency can be sustained, and thus the excellent visual recognition property of an electronic part can be provided. Furthermore, since the conductive layer can be provided on the substrate rear surface as well as formation of a thin film can be enabled even in the case of providing the conductive layer on the adhesive layer front surface, the adhesive property of the adhesive layer cannot be deteriorated so that variation in the peel strength at the time of peeling off can be reduced. Therefore, various step troubles can be prevented in a series of steps from the conveyance to the assembly in a circuit board, and thus the reliability of the part and the reliability in mounting can be improved dramatically.

Hereinafter, the invention will be explained in further detail with reference to examples, but the present invention

is not limited to these examples.

Example 1

100 parts by weight of an ethylene/vinyl acetate (EVA)
resin (produced by Mitsubishi Plastics, Inc., product name:
5 "LV360"), 15 parts by weight of an alicyclic saturated
hydrocarbon based resin (produced by Yasuhara Chemical Co.,
Ltd., product name: "Clearon P115"), 0.5 part by weight of an
antioxidant (produced by Chiba Special Chemicals Corp., product
name: "IRG#1010"), and 1.0 part by weight of a nonionic
10 surfactant (produced by NOF Corporation., product name: "Nonion
HS-210") were melted and mixed by a two-axes kneader. After
co-extrusion with a polyethylene (PE), it was bonded with a
polyester film via a urethane adhesive by a dry lamination method
so as to produce a tape (total thickness 50 μm) having a layer
15 configuration with the adhesive layer (EVA; thickness 15
 μm)/intermediate layer (PE; thickness 10 μm)/base coating layer
(urethane adhesive; thickness 0.5 μm)/substrate (polyester;
thickness 25 μm). Deposition was applied on the substrate front
surface and the adhesive layer front surface of the tape, using
20 a metal SUS for forming conductive layers each of a 0.007 μm
thickness and a 0.005 μm thickness so as to obtain a cover tape.

Example 2

A resin composition obtained by melting and mixing 80
parts by weight of a middle density polyethylene (middle density
25 PE; produced by Mitsui Chemicals, Inc., product name: "NEO-ZEX

40150C"), 20 parts by weight (polymer total 100 parts by weight)
of a potassium ionomer (produced by Mitsui Dupont Polychemical
Corp., product name: "SD100"), 20 parts by weight of a petroleum
based resin (product name: "Alkon P-90"), and 0.5 part by weight
5 of a phenol antioxidant (produced by Ciba-Geigy, product name:
"Irganox 1010") by a two-axes kneader, and a blended product
of 100 parts by weight of a polyethylene (PE) and a high molecular
weight polypropylene (high molecular weight PP) and 10 parts
by weight of an electrification preventing agent (quaternary
10 ammonium salt, and the like) added thereto were processed by
the three layer co-extrusion so as to produce a tape (total
thickness 55 μm) having a layer configuration with the adhesive
layer (middle density PE + potassium ionomer; thickness 15
 μm)/intermediate layer (PE; thickness 15 μm)/substrate (high
15 molecular amount PP; thickness 25 μm). Deposition was applied
on the substrate front surface of the tape, using a metal Al
for forming a conductive layer of a 0.004 μm thickness so as
to obtain a cover tape.

Comparative Example 1

20 70 parts by weight of a styrene-butadiene-styrene block
copolymer (SBS; styrene content 20% by weight) and 30 parts
by weight of an ethylene- α -olefin copolymer resin were dry
blended. With 30 parts by weight of a tin oxide as a conductive
agent added thereto, it was kneaded and pelletized. The
25 obtained pellets and a PE resin were processed by the two layer

co-extrusion by an inflation extruder so as to form a film. A corona treatment was applied to the surface of the PE layer of the obtained film. A polyethylene terephthalate (PET) film was laminated by a dry lamination method, using a urethane adhesive. An aging treatment was applied at 50°C for 24 hours so as to produce a tape (total thickness 46 μm) having a layer configuration with the conductive agent containing adhesive layer (SBS + ethylene- α -olefin copolymer resin + conductive agent; thickness 15 μm)/intermediate layer (PE; thickness 15 μm)/base coating layer (urethane adhesive; thickness 0.5 μm)/substrate (PET; thickness 16 μm).

Comparative Example 2

75 parts by weight of an ethylene/vinyl acetate (EVA) resin (vinyl acetate content 15% by weight) and 25 parts by weight of an ethylene- α -olefin copolymer resin were dry blended. With 0.5 parts by weight of a quaternary ammonium salt as an electrification preventing agent added thereto, it was kneaded and pelletized. The obtained pellets and a PE resin were processed by the two layer co-extrusion by a T dice extruder so as to form a film. A corona treatment was applied to the surface of the PE layer of the obtained film. An electrification preventing polyethylene terephthalate (PET) film was laminated by a dry lamination method, using a urethane adhesive. An aging treatment was applied at 50°C for 24 hours so as to produce a tape (total thickness 50 μm) having a layer configuration

with the electrification preventing agent containing adhesive layer (EVA + ethylene- α -olefin copolymer resin + electrification preventing agent; thickness 15 μm)/intermediate layer (PE; thickness 10 μm)/base coating layer (urethane adhesive; thickness 0.5 μm)/substrate (electrification preventing PET; thickness 25 μm).

Evaluation Test

The following tests were executed for each of the tapes obtained in the examples and the comparative examples. Results are shown in the table 1.

(Total Thickness)

The tape total thickness (μm) was measured with a 1/1,000 mm dial gauge.

(Tensile Strength and Ductility)

It was measured by a 300 mm/minute elastic stress rate condition by a Tensilon.

(Adhesive Force with respect to Embosses)

The adhesive layer surface of the tape was superimposed on the surface of a polystyrene sheet with embosses formed. After pressing by a heat sealer for 0.5 second by a 140°C and pressure 2.5 kgf/cm² (250 kPa) condition, a peeling force was measured at a peeling rate 300 mm/minute, peeling angle about 180° condition in an ordinary temperature (average value of three times). Moreover, the difference of the maximum value and the minimum value of the measurement values of the tests

executed three times (adhesive force min-max) was calculated.
(Surface Resistivity)

The surface resistivity of the adhesive layer side surface and the substrate side surface was measured by a minute
5 current electrometer.

(Half Life Value)

Based on the JIS L 1094, the half life was measured by a static honest meter. The half life value denotes the time needed for the voltage generated by electrification of the tape
10 substrate side surface, reaching to the value half as much as the initial voltage.

(Frictional Electrification Voltage)

Based on the JIS L 1094, the electrification voltage was measured after rubbing the tape adhesive layer side surface
15 with cloth. Moreover, with a 20°C, 25% RH condition, the frictional electrification voltage was measured as a frictional electrification voltage under a low humidity.

(Part Adhesion Property (=Adhesion to part))

With the tape adhesive layer and chips (50 pieces)
20 contacted, after heating at 50°C for 10 minutes, the chip adherence ratio was found.

(Light transmittance)

The light transmittance of the tape was measured by a haze meter.

	Example 1	Example 2	Comparative Example 3	Comparative Example 2
Total thickness (μm)	50	55	46	50
Tensile strength (N/5.25mm)	25	15	23	25
Ductility (%)	120	270	120	124
Adhesive force with respect to embosses (N/2mm)	0.20	0.30	0.40	0.15
Adhesive force min-max (N/2mm)	0.03	0.06	0.18	0.10
Surface resistivity (Ω/\square):				
Adhesive-layer-side surface	1.5×10^7	2.7×10^{11}	2.0×10^{10}	3.6×10^{11}
Substrate-side surface	5.0×10^6	1.5×10^8	-	2.0×10^{10}
Half life value (sec)	0	0	15	30
Frictional electrification voltage (V)	5	4.5	35	105
Frictional electrification voltage under low humidity (V)	5	16	260	235
Part adhesion property (%)	0	0	15	5
Light transmittance (%)	87	75	35	80

The entire disclosure of each and every foreign patent application from which the benefit of foreign priority has been claimed in the present application is incorporated herein by reference, as if fully set forth herein.